8 FLORA, FAUNA, PRECIPITATION, SOILS, AND PECONIC RIVER

CHAPTER CONTENTS

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FISH, SHELLFISH, AQUATIC VEGETATION, AND SEDIMENT

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 3, December 4, 2007

IMPLEMENTATION DATE January 1, 2008

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

Due to long term data sets on fish indicating few pesticides and PCB's within fish off site of BNL, sampling efforts will be reduced to typical food fishes and will limit fish taken to bottom feeders (brown bullhead) and top predators (largemouth bass, chain pickerel, black crappie, or yellow perch). Analysis is being reduced to metals and gamma emitting radionuclides, with metals analysis taking priority over radionuclide analysis.

DESCRIPTION AND TECHNICAL BASIS

BNL has historically carried out surveillance monitoring of fish, shellfish, aquatic vegetation, sediments, and water within the Peconic River and control locations. The purpose of the surveillance monitoring has been in support of reactor operations, STP operations, environmental management programs (CERCLA), and the Peconic Estuary Program. Historic data typically indicates the presence of Cs-137, various heavy metals, PCBs, and certain pesticides within the various aquatic media at locations on site, with declining concentrations downstream of BNL. Historic data consistently indicates that there is no effect from BNL operations far downstream of the site boundary and suggest that a reduction in the surveillance monitoring is justified. This DQO will establish the decision criteria to decrease or increase aquatic surveillance monitoring, as necessary. This balanced approach will provide flexibility to the monitoring program.

Fish have been sampled since the early 1990s to support reactor operations as well as discharge, monitoring, and environmental restoration activities. Fish sampling has historically occurred at several locations along the Peconic River, including on-site reaches, Swan Pond, Donahue's Pond, Forge Pond, and at Lower Lake on the Carmans River (control location). Annual sampling on site at BNL between 1990 and 1999 has resulted in a depletion of the number and size of fish available for sampling. As a result, BNL sampling was suspended to allow the fish population to recover. Drought and clean-up operations have prevented the re-establishment of sufficient fish populations for sampling, and the suspension of on site sampling will continue until the populations recover. In 2007, sufficient numbers and sizes of fish were present onsite to allow sampling. Continued flows within the Peconic River throughout 2007 suggest that fish sampling will be supported in 2008. Results of sampling at other areas along the Peconic River have shown a decline in the levels of Cs-137 found in fish, both over time and distance from BNL. However, fish sampling has also consistently shown the presence of PCBs, pesticides, and some heavy metals, attributable to historical BNL practices, in fish tissues along the Peconic River.

Shellfish have been sampled since 1995 in the Peconic River from Connecticut Avenue downstream to the Peconic Bay, with control locations varying from place to place away from the river

system. Shellfish sampling was conducted to document any potential impacts posed by BNL operations, as well as to monitor contaminants potentially affecting the Peconic Estuary. Historic data has indicated levels of Cs-137 that can be considered background in nature ($\leq$ 1.0 pCi/g wet weight), most likely due to atomic weapons testing fallout. The continued need for collecting shellfish samples at significant distances from BNL can now be evaluated, and sampling of shellfish can possibly be discontinued, provided adequate protocols are in place to allow for the resumption of shellfish sampling, should the need arise. Based on evaluation shell fish were removed from monitoring in 2003.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

____ Compliance
_x_ Support compliance
_x_ Surveillance
_x_ Restoration

- DOE Order 450.1, Environmental Protection Program (2003), requires that DOE sites maintain surveillance to monitor the effects, if any, of DOE activities on the on- and off-site environment and natural resources. DOE Order 5400.5, Radiation Protection of the Public and Environment (1990), requires DOE sites to maintain surveillance monitoring for determining radiological impacts to the public and environment.

- Surveillance monitoring to determine impacts from discharges from the STP can also be considered a "best management practice" to ensure the early detection of potential contamination in order to better protect the public and environment.

- Surveillance monitoring to document continued effectiveness of environmental cleanup operations and trends of changing levels of contaminants in fish is also considered a "best management practice."

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Past practices at BNL have resulted in contaminants being released to the Peconic River System. These contaminants were released from the STP and entered the river at the discharge point with eventual migration downstream. Recent upgrades to the STP include treatment to a tertiary level and have greatly reduced the potential of future releases of contaminants (conventional and radiological). Radiological effects may have been lessened due to the E-ALARA process, as well as sewer cleaning and remediation of the sand filter beds at the STP. However, there is always a slight potential that contaminants could be released in an upset situation (tritium and other contaminants are continually released, under permit). The problem that exists for the monitoring program is documentation of the continued decline in existing contaminants, documentation of the success of cleanup operations along the river, and having a mechanism to complete additional sampling of sediments, shellfish, and aquatic vegetation far downstream in the Peconic River and Peconic Estuary, should the need arise.

Step 2: Identify the Decision

The desired decisions for the fish, shellfish, vegetation, and sediment surveillance monitoring programs can be represented through the following questions:

- Are contaminants attributable to BNL operations present in fish, shellfish, vegetation, and sediment within the Peconic River System?
- Are fish populations and fish sizes on site large enough to support resumption of surveillance monitoring?
- Are the levels of known BNL-contributed contaminants declining in fish, vegetation, and sediment within the Peconic River System?
- Are cleanup actions reducing contaminants in fish, vegetation, and sediments within the Peconic River?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- DOE-established dose guideline of 10 mrem/year for the general public
- STP discharge monitoring data
- NYSDEC consumption guidelines: 15 lb/year/person of fish for dose assessment
- EWMSD field logs and records maintained by field sampling personnel
- EWMSD Environmental Monitoring SOPs
- Documented remediation of contaminated river sediments
- Records of Decision for the STP remediation in OU V
- Closeout reports for the STP and Peconic River Cleanup Projects
- Historic aquatic vegetation sampling results
- Historic sediment sampling results
- Historic Peconic River surface water sampling results
- Historic shellfish results
- Historic fish results

Step 4: Define the Study Boundaries

The boundaries of this study include the Peconic River system from the STP outfall on site, extending downstream to the Peconic Bay. Control locations for comparison data are Lower Lake on the Carmans River for fish, sediment, and vegetation and Moriches Bay for shellfish, sediment, and vegetation related to shellfish sampling. Sampling is carried out during the summer months when peak growth periods occur, generally June through September each year.

Step 5: Develop the Decision Rule

Decision 1

Are contaminants attributable to BNL operations present in fish, shellfish, vegetation, and sediment within the Peconic River System?

If surveillance monitoring of fish, shellfish, vegetation, and sediments detect BNL-attributed contaminants such as heavy metals, Cs-137, PCBs, or pesticides, **then** surveillance monitoring shall continue.

If historic data for fish, shellfish, vegetation, and sediment in an area of the Peconic River System indicates that BNL-attributed contaminants are not present or are at background levels or below, **then** surveillance monitoring shall be suspended. In a situation where surveillance monitoring in a section of the Peconic River is suspended, the following decision rule will apply:

If upstream surveillance monitoring of any media indicates increasing levels of a contaminant of concern, **then** an evaluation will be conducted under the EWMSD Environmental Event Response Procedure.
If during the evaluation it is determined that additional monitoring is necessary, **then** monitoring at downstream locations, with appropriate control locations, will be reinstituted.

Decision 2

Are fish populations and fish sizes on site large enough to support resumption of surveillance monitoring?

If annual fish population and size surveys indicate that sufficient numbers of fish exist at large enough sizes for sampling, **then** surveillance monitoring of fish shall resume on site at BNL.

If annual fish population and size surveys indicate insufficient numbers of fish and/or fish are not of significant size for sampling, **then** surveillance monitoring will remain suspended and annual population and size surveys will continue to facilitate population recovery.

Note: In the above decision rules, "sufficient" body and population size means that enough fish exist to (1) support the preparation of a 1-kg-sample of each species desired and (2) be taken without disrupting the population. This requires that enough fish of reproductive age remain in the river for the population of each species to survive and reproduce, so we are able to obtain surveillance samples the following year.

Decision 3

Are the levels of known BNL-contributed contaminants declining in fish, vegetation, and sediment within the Peconic River System?

Historic sampling of river flora and fauna has typically indicated that radionuclide concentrations are declining, while other contaminants have no consistent pattern of increase or decline.

If trending continues to show declining levels of contaminants in fish, vegetation, and sediments, **then** re-evaluation of the monitoring program will occur when values reach background.

If trends in contaminant concentrations in fish, vegetation, and sediment are found to be increasing, **then** an evaluation will be conducted under the EWMSD Environmental Event Response Procedure to review the data and determine any changes in the environmental monitoring requirements, and whether further action should be taken.

Decision 4

Are remediation actions resulting in reduction of contaminants in fish, vegetation, and sediments within the Peconic River?

Since cleanup of the upper reaches of the Peconic River is complete, surveillance monitoring should document the effectiveness of the cleanup.

If surveillance-monitoring trends indicate a decline in contaminants in fish, vegetation, and sediments in the Peconic River, **then** surveillance will continue until values reach the background levels (found in control locations). When values are at background levels, the need for further surveillance shall be evaluated.

If surveillance-monitoring trends indicate a flat or climbing trend, **then** the data shall be reviewed and the need for modifications to the monitoring program shall be assessed.
If the assessment indicates that further monitoring is necessary, **then** an evaluation under the EWMSD Environmental Event Response Procedure shall be completed to identify all aspects of the continued presence of contaminants in the Peconic River System.

Step 6: Specify Acceptable Error Tolerances

Because the upper reaches of the Peconic River are typically fed by the discharges from the BNL STP, the effects of these discharges must be monitored. Historic discharges have resulted in various contaminants accumulating in river sediments. Monitoring data should be of sufficient quality to measure constituents to the same level of detection used for drinking water standards. False positives and negatives should be minimized and data should not have excessive qualifiers attached if the values are above minimum detection limits. Duplicate sampling will be submitted (when possible) at a rate of 10 percent of the sample collection in order to check and verify lab quality.

Step 7: Optimize the Design

In order to document recovery of fish populations and size classes in the on-site portion of the Peconic River, an annual survey will be conducted. The survey will utilize electro-shocking and other appropriate sampling techniques to collect the highest number fish possible with reasonable effort. All fish collected will be identified to species, and, at a minimum, will have total body length measured. Total numbers sampled will be recorded. Areas of coverage will be (at a minimum) from 150 ft east of the east firebreak up to the outfall of the STP.

Fish sampling will include at least five samples of each species of fish, as is practical or available, including brown bullhead; chain pickerel or largemouth bass or yellow perch. Fish from different feeding guilds (bottom feeders, predatory fish, etc.) are sampled to document potential pathways of contaminants through the food chain and up to the level of potential human consumption (game fish). Samples will be taken from the following locations, including but not limited to, BNL (when population sizes permit), Swan Pond, Donahue's Pond, Forge Pond on the Peconic River, and Lower Lake on the Carmans River (control location). Fillets of larger species of fish will be utilized as being representative of edible portions. Radionuclide (Gamma) analysis may require composite sampling two or more fish to ensure sufficient sample volume for analysis. In order to maximize analytical process, sample analysis will be conducted in priority order of mercury, metals, PCBs/Pesticides (onsite and Donahue's pond samples only), then gamma emitting radionuclides. It may be necessary to take separate samples or composite samples to gather radionuclide data. Smaller species will be composited and analyzed as whole body and be indicative of prey- or bait-type fish.

Fish sampled under the Peconic River Post-Cleanup DQO on site at BNL and at Donahue's Pond will also be tested for Pesticides and metals other than mercury.

In addition to fish sampling from the above ponds, a sediment sample and a single vegetation sample of any abundant emergent aquatic plant will be taken (3 samples from on site at BNL). Sufficient material will be taken in order to complete analysis for gamma-emitting radionuclides, PCBs/pesticides (BNL and Donahue's Pond only), and metals.

2008 Aquatic Surveillance Monitoring Program

Matrix	Location	Number of Samples	Analysis	Frequency	Sample Type
Fish	BNL	10 + 1QA*	PCBs/Pesticides, Metals	Annual	Grab
	Swan Pond	10 + 1QA	Gamma, Metals	Annual	Grab
	Donahue's Pond	10 + 1QA*	Metals	Annual	Grab
	Forge Pond	10 + 1QA	Gamma, Metals	Annual	Grab
	Lower Lake, Carmans River	10 + 1QA	Gamma, Metals	Annual	Grab
Vegetation	Swan, Donahues, Forge Ponds, Carmans River BNL	8 + 1QA	Gamma,PCBs/Pesticides (BNL), Metals	Annual	Grab
Sediment	Swan, Donahues, Forge Ponds, Carmans River	4	Gamma, Metals	Annual	Grab
Water	Swan, Forge, Donahues, Carmans River	4	Gamma, Metals	Annual	Grab
Water	Meadow Marsh	1	Metals, Nutrients, Water Quality Parameters	Annual	Grab
Fish	BNL (as needed)	Population Survey	Length and Weight (if possible)	Annual	Grab

TOTAL SAMPLING AND ANALYSIS COST FOR MONITORING PROGRAM

The proposed sampling program will result in a $5,753 decrease in sampling and analysis cost.

FY2007 Costs $45,993
FY2008 Costs $36,500
Difference -$9,493

See Appendix B for the monitoring program for this DQO.

PECONIC RIVER POST-CLEANUP MONITORING

DQO START DATE January 1, 2007

REVISION NUMBER/DATE Rev. 1, December 13, 2007

IMPLEMENTATION DATE January 1, 2008

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

After five years of annual monitoring (through 2010), BNL/DOE will evaluate all environmental data collected since completion of the cleanup for each of the ROD-required monitoring activities (sediment, surface water, fish). BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them to EPA, NYSDEC, and SCDHS as part of the BNL Five-Year Review. Previously, this was being performed after three years of data review (through 2008).

DESCRIPTION AND TECHNICAL BASIS

BNL completed the cleanup and restoration of the Peconic River in May 2005. The cleanup operation removed sediment containing mercury and other co-located contaminants including PCBs, pesticides, heavy metals, and Cs-137 from approximately 19 acres of the river starting at the STP outfall and extending to the area of Manor Road approximately 4.5 miles downstream of the BNL STP. Cleanup resulted in an average level of mercury in the remaining sediments of approximately 0.2 ppm and removal of approximately 90 percent of the co-located contaminants.

This DQO describes the post-remediation environmental monitoring that will be performed to demonstrate compliance with the OU V Peconic River ROD. To promote sampling efficiency, some environmental samples will also be analyzed to meet the requirements of the surveillance monitoring program. The mission of the surveillance monitoring program is to provide early detection of potential releases of contaminants through environmental monitoring not otherwise required by remediation-required or permit-required compliance monitoring.

Because potentially remaining contaminated sediment presents the greatest source of potential mercury bioaccumulation in fish, both sediment and fish will be sampled once annually to monitor the long-term effectiveness of the cleanup. Sediment will be monitored for mercury, PCBs, and Cs-137. Silver and copper also pose a potential threat to the aquatic community. Additional analyses will be performed for these analytes on one sediment sample within each of the five fish collection areas. Each sediment sample will also be analyzed for pesticides as part of the surveillance monitoring program. Fish will be analyzed for mercury and radionuclides in fish tissue. As required by the ROD, fish collected on the Laboratory property will also be monitored for PCBs. Fish will be sampled when collections can be made without impacting the wellbeing of the fish population. Surface water samples will be collected twice annually (June and August) and analyzed for mercury, methyl mercury, and Total Suspended Solids (TSS).

The continued effectiveness of the cleanup during the first five years will be evaluated through an annual review of the sampling data with EPA, NYSDEC, and SCDHS. On an annual basis, sampling modifications will be made for subsequent sampling, if necessary.

For each of the ROD-required monitoring activities (sediment, surface water, fish), after five years of annual monitoring BNL/DOE will evaluate all environmental data collected since completion of the cleanup. BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS as part of the BNL Five-Year Review.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

____ Compliance
_x_ Support compliance
_x_ Surveillance
_x_ Restoration

- Operable Unit V Record of Decision for Area of Concern 30 (Peconic River).
- Final Closeout Report, Peconic River Remediation Phases 1 and 2.
- Operable Unit I Soils and Operable Unit V Long-Term Monitoring and Maintenance Plan.
- Peconic River post-cleanup monitoring data can be used to determine impacts from discharges from the STP. Collection of this monitoring data can also be considered a "best management practice" to ensure the early detection of potential contamination in order to better protect the public and environment.
- Surveillance monitoring to document continued effectiveness of environmental cleanup operations and trends of changing levels of contaminants in sediments and water column is also considered a "best management practice."

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Past practices at BNL have resulted in contaminants being released to the Peconic River System. These contaminants were released from the STP and entered the river at the discharge point with eventual migration downstream. Recent improvements to the STP and pollution prevention practices include upgrades of the treatment system to the tertiary level, improved waste minimization and waste handling practices, and minimized use of specific (e.g. mercury and silver) hazardous materials. Sewer cleaning and remediation of the sand filter beds at the STP and minimization of mercury sources throughout the Laboratory lessen the likelihood of mercury being released to the Peconic River System. These improvements have greatly reduced the potential for future releases of contaminants (conventional and radiological). However, there is always a slight potential that contaminants could be released in an upset situation, and very small amounts of mercury are permitted to be released under BNL's SPDES permit.

The problem that this monitoring program addresses is documenting the achievement and maintenance of the cleanup goals required by the Peconic River ROD with data of appropriate quality to meet CERCLA and ROD mandates.

The Peconic River cleanup was completed in 2005 and annual post-cleanup monitoring was initiated in 2006. The monitoring will continue until the remedial action has been demonstrated to be protective of human health and the environment. The Peconic River monitoring program is de-

signed such that if the value of a sediment sample is greater than or equal to 2.0 mg/kg, then the nature and extent of mercury contamination will be characterized in a one hundred square foot area surrounding the original sample point. Sampling modifications will be made for subsequent sampling, if necessary. After five years of annual monitoring, BNL/DOE will evaluate all environmental data that have been collected since the completion of the cleanup. BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS as part of the BNL Five-Year Review.

The annual monitoring will be guided by the DQO analysis and monitoring summaries that follow and are detailed in the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan. The monitoring data will be summarized in an annual Peconic River Monitoring Report which BNL/DOE will submit to EPA, NYDEC, and SCDHS for review. The DQO process that follows will be used to guide data interpretation and recommendations to the regulators made each year in the Annual Peconic River Monitoring Report. The DQO decisions may be modified in response to potential changes in data needs.

Step 2: Identify the Decision

The desired decisions for demonstration of the success of the Peconic River cleanup can be represented through the following question:

Have cleanup actions reduced the amount of mercury, PCBs, and radionuclides in the sediments and fish and reduced the amount of mercury and methyl mercury in the water column to levels protective of human health and the environment in sections of the Peconic River impacted by BNL operations?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- Baseline monitoring before cleanup of the Peconic River.
- Post-cleanup sediment confirmation data.
- Control location monitoring data for the Connetquot River reference station.
- STP discharge monitoring data.
- EWMSD field logs and records maintained by field sampling personnel.
- EWMSD Environmental Monitoring standard operating procedure.
- RODs for the STP and Peconic River remediation in OU V.
- Closeout reports for the STP and Peconic River Cleanup Projects.
- Data summary reports for mercury and methyl mercury for Peconic River surface water.

Step 4: Define the Study Boundaries

The boundaries of this study include the Peconic River cleanup area from the BNL STP outfall, downstream to approximately one quarter mile east of Manor Road. The downstream extent of monitoring is at Connecticut Avenue, approximately 2.6 miles downstream of Manor Road. A control location for comparison of the surface water data is located at the Connetquot River, approximately 20 miles to the southwest of BNL. Data collection and temporal boundaries include sediment sampling in June, regardless of water level; surface water sampling in June and August; and fish sampling between May and August. If necessary, to avoid potential drought or high water periods, fish and surface water collections may occur somewhat earlier or later.

Step 5: Develop the Decision Rule

Decision 1

Are the levels of BNL-attributable contaminants present in annual Peconic River sediment samples remaining stable relative to mercury cleanup goals?

If the average annual mercury concentration in sediment remains below the cleanup limits of 1.0 ppm and 0.75 ppm for samples collected on and off laboratory property, respectively, and no individual sample equals or exceeds the goal that all mercury concentrations in the remediated areas are less than 2.0 ppm following the cleanup, **then** the current sampling plan will continue to be implemented without modification between 2006 and 2010.

If any individual sediment sample equals or exceeds the goal that all mercury concentrations in the remediated areas are less than 2.0 ppm following the cleanup, **then** BNL/DOE will characterize the nature and extent of contamination in the area surrounding the sample point(s) with the elevated value(s). The detailed characterization will be implemented by re-sampling the original data point location plus four additional sample points located 5 feet upstream, 5 feet downstream, 5 feet to the left, and 5 feet to the right of the original sample, thus characterizing a 100 square foot area. **If** the average mercury concentration of the five resample points is greater than or equal to 2.0 ppm, **then** additional nature and extent sampling of the sediment in the area of the elevated sediment mercury concentrations will be required. This data will be evaluated to assess the potential for the elevated sediment mercury concentrations to require near-term cleanup to prevent impact to human health and the environment.

If after five years of sediment sampling (through 20010) the average annual mercury concentration in sediment remains below the cleanup goals of 1.0 ppm and 0.75 ppm for samples collected on and off laboratory property, respectively, and no sample equals or exceeds the goal that all mercury concentrations in the remediated areas are less than 2.0 ppm following the cleanup, **then** BNL will evaluate and recommend to EPA, NYSDEC, and SCDHS that the ROD-required Peconic River sediment sampling be replaced with routine long-term surveillance sampling beyond 20010.

If after five years of sediment sampling (through 2010) the average annual mercury concentration in sediment equals or exceeds the cleanup goals of 1.0 ppm and 0.75 ppm for samples collected on and off laboratory property, respectively, and/or sediment sample(s) equal or exceed the goal that all mercury concentrations in the remediated areas are less than 2.0 ppm following the cleanup, **then** BNL/DOE will evaluate all environmental data collected since completion of the cleanup. BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS as part of the BNL Five-Year Review.

Decision 2

Are the average levels of BNL-attributable mercury, PCBs, and radionuclides in Peconic River fish trending toward levels that are protective of human health?

After the concentrations of environmental contaminants in sediment are removed or reduced, the body burden of contaminants in fish tissue typically require several years for substantial reduction depending on the contaminant, the environment, and the feeding guild. For this reason, the con-

centrations of contaminants in fish tissue resulting from each year of monitoring between 2006 and 2010 should be trended relative to the pre-cleanup levels.

If the annual levels of BNL-attributable mercury, PCBs, and radionuclides in Peconic River fish are trending toward levels that are more protective of human health, **then** BNL/DOE will continue to monitor Peconic River fish as required by the Peconic River ROD.

If the annual levels of BNL-attributable mercury, PCBs, and radionuclides in Peconic River fish are trending toward levels that are less protective of human health, **then** BNL/DOE will evaluate and recommend to EPA, NYSDEC, and SCDHS that sampling protocols be modified to better characterize potential source terms.

If after five years of fish sampling the average levels of BNL-attributable mercury, PCBs, and radionuclides in Peconic River fish are at levels protective of humans, **then** BNL/DOE will propose to EPA, NYSDEC and SCDHS that fish monitoring required by the Peconic River ROD be replaced by long-term surveillance monitoring beyond 2010.

If after five years of fish sampling the average levels of BNL-attributable mercury, PCBs, and radionuclides in Peconic River fish are not trending toward levels that are protective of human health, **then** BNL/DOE will evaluate all environmental data collected since completion of the cleanup. BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS as part of the BNL Five-Year Review.

Decision 3

Have cleanup actions reduced the amount of mercury and methyl mercury in the water column in the Peconic River?

Confirmatory sampling of Peconic River sediments at the time of cleanup of the Peconic River indicate that, on average, the level of mercury in sediments is approximately 0.2 ppm and co-located PCBs and Cs-137 were reduced by approximately 90 percent. Mercury and methyl mercury analysis of the water column samples is geared toward indicating the section(s) of the river with the most optimal conditions for contributing total mercury and methyl mercury from the sediment to the water column and converting inorganic mercury to methyl mercury.

If sampling and trending shows declining levels over five years of mercury and methyl mercury in the water column, **then** BNL will re-evaluate the methyl mercury monitoring program when values have been maintained or decline over a period of five years or if the methyl mercury monitoring program data has not been useful in evaluating the long-term effectiveness of the remedy. Re-evaluation will consider whether the methyl mercury sampling program should be maintained at the current level or, modified. After five years of annual monitoring BNL/DOE will evaluate all environmental data collected since completion of the cleanup. BNL/DOE will then recommend future monitoring activities, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS for review.

If sampling and trending shows that mercury and methyl mercury in the water column have been increasing in concentration have been increasing over the past five years, **then** BNL/DOE will evaluate all environmental data collected since completion of the cleanup. BNL/DOE will then recommend future monitoring activities and/or response actions, as appropriate, and submit them in 2011 to EPA, NYSDEC and SCDHS as part of the BNL Five-Year Review.

Step 6: Specify Acceptable Error Tolerances

Because the monitoring data discussed in this section and detailed in the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan are collected to satisfy the sampling requirements specified in the Peconic River ROD and to facilitate comparison with pre-cleanup characterization data, the monitoring data must meet the CERCLA specifications by which the Peconic River pre-remediation and confirmation data were collected. Data will be reported in Full EPA CLP style. Analytical methods and Quality Assurance/Quality Control (QA/QC) requirements are specified in the OU I Soils and OU V Long Term Monitoring and Maintenance Plan, Appendix C.

Step 7: Optimize the Design

Analytical results from Peconic River sediment, fish, and surface water sampling will be used to document the condition of the Peconic River resulting from cleanup operations and will be evaluated on an annual basis to determine whether modification or additional optimization are needed. Sediment samples will be collected annually in June from 30 locations along the Peconic River from just upstream of the BNL STP outfall and extending through the Manor Road cleanup area and ending in Donahue's Pond. Samples will be analyzed for mercury, PCBs, and radionuclides. Samples will be collected at each of the sample locations regardless of whether it is covered by water. Within each sample area, fine-grained depositional sediment will be selected for sampling. Five of the 30 samples (17 percent), indicated with an asterisk in the following table, will be collected within the areas from which fish will be sampled. These sediment samples will be analyzed as part of the surveillance program for mercury, silver, copper, and pesticides to survey for potential ecological risks, as well as PCBs and gamma emitting radionuclides. If Peconic River water levels are sufficiently low, the sediment trap upstream of station HQ will be evaluated in the Annual Report for removal as required by the Peconic River ROD. An additional three sediment samples will be collected from within and beneath the sediment trap when it is removed. These samples will be analyzed for TAL metals, pesticides, PCBs, and gamma-emitting radionuclides and will be used to support the disposal of the sediment.

Table 8.2.1 Peconic River Sediment Sampling Locations

PR-SS-01*	PR-SS-14	PR-SS-29
PR-SS-02	PR-SS-15	PR-SS-30
PR-SS-03	PR-SS-16*	PR-SS-31
PR-SS-04	PR-SS-17	PR-SS-33*
PR-SS-05	PR-SS-18	PR-SS-35
PR-SS-06	PR-SS-19	PR-SS-37
PR-SS-07	PR-SS-21	PR-SS-38
PR-SS-09	PR-SS-23	PR-MR-01*
PR-SS-10	PR-SS-24	PR-MR-02
PR-SS-12	PR-SS-26	PR-DP-01*

Note:
* PR-SS-01, PR-SS-16, PR-SS-33, and PR-MR-01 will be collected from fish sampling locations within remediation areas P, D, A, and Manor Road, respectively. PR-DP-01 is from Donahue's Pond, located downstream of the remediated sections of the river.

Fish samples will be collected from five sections of the Peconic River. To the extent that water level, fish abundance, and size allow, fish will be collected from the sections of the river detailed in Table 8.2.2.

Table 8.2.2 Peconic River Fish Collection Locations

Remediation Area	Location Description
Area A	Between stream gauging stations HE and HMn.
Area D	Along North Street in the ponded sections of the river upstream and downstream of stream gauging station HQ. If water level or fish population size is not sufficient for fish collection, the ponded section of the river in remediation Area C may be substituted.
Area P	Upstream of Schultz Road. If water level or fish population size is not sufficient for fish collection, the Ice Pond in remediation Area P may be substituted.
Manor Road	Within the section of the Peconic River between approximately 100 yards upstream and downstream of Manor Road.
Donahue's Pond	Donahue's Pond is an impounded section of the Peconic River at the Peconic River Sportsman's Club.

To the extent possible, five fish of sufficient size to obtain an edible fillet will be collected for analysis from each of two feeding guilds. Brown bullhead and/or white sucker will represent the bottom feeding guild. Chain pickerel and/or large mouth bass will represent the carnivore feeding guild. Sunfish may be used if chain pickerel or bass are not available. If fish sizes are insufficient to obtain fillets smaller, fish may be composited for a whole body analysis. All analytical results will be reported as wet weight mass of contaminant per unit mass of fish tissue.

Surface water samples will be taken from 21 locations in June and August (provided sufficient water is present) along the Peconic River beginning just west of the BNL STP outfall and ending at Connecticut Avenue. The sampling locations also include an additional sample (sample 22) at a control location at the Connetquot River reference station in western Suffolk County.

Table 8.2.3 Locations of Water Column Sampling Stations

Station	Description	Distance Downstream of STP (miles)
PR-WC-14	Upstream of STP	0.1
PR-WC-13	Upstream of STP	0.1
PR-WC-12	Upstream of STP	0.1
PR-WC-11	STP Outfall	0.0
PR-WC-10	West of HMn	0.3
PR-WC-09	Downstream of HMn	0.6
PR-WC-08	South of Area B	0.8
PR-WC-07	South of Area C	1.0
PR-WC-06	North of Area D	1.1
PR-WC-05	Downstream of HQ	1.5
PR-WC-04	2nd Downstream of HQ	1.8
PR-WC-03	3rd West of Schultz Road	2.2
PR-WC-02	2nd West of Schultz Road	2.6
PR-WC-01	1st West of Schultz Road	3.1
PR-WCS-01	Schultz Road	3.5
PR-WCS-02	East of Schultz Road	4.0
PR-WCS-03	West of Manor Road	4.5
PR-WCS-04	Manor Road	4.8
PR-WCS-05	West of Cranberry Bogs	6.0
PR-WCS-06	East of Cranberry Bogs	6.6
PR-WCS-07	Connecticut Avenue	7.1
Connetquot River	Reference Site in Connetquot River	-

Additional water quality sampling will supplement the mercury and methyl mercury Peconic River surface water collections. The purpose of this sampling is to track potential changes in the Peconic River water quality following the remediation. The samples are to be collected at each of the 21 Peconic River methyl mercury stations during the two annual methyl mercury sampling rounds and at eight of the methyl mercury stations in four additional sampling rounds. The four

additional sampling rounds will be collected 2 weeks prior to and 2 weeks after the June and August methyl mercury collections. A total of 74 water quality samples will be collected on an annual basis. Table 8.2.4 indicates the sampling frequency, stations, and analytes.

Table 8.2.4 Water Quality Stations, Schedule, and Analyses

Station	Schedule	Analyses
PR-WC-14	June and August	Laboratory Analyses Chlorophyll-a, Total Phosphorus, Total Nitrogen, Nitrate/Nitrite Total Kjeldahl Nitrogen (TKN), Total Organic Carbon (TOC), Total Suspended Solids (TSS) Field Measurements Turbidity, Dissolved Oxygen (DO), pH, Temperature, Depth
PR-WC-13	June and August	
PR-WC-12	June and August	
PR-WC-11	June and August	
PR-WC-10*	June and August	
PR-WC-09*	June and August	
PR-WC-08*	June and August	
PR-WC-07	June and August	
PR-WC-06*	June and August	
PR-WC-05	June and August	
PR-WC-04*	June and August	
PR-WC-03*	June and August	
PR-WC-02	June and August	
PR-WC-01*	June and August	
PR-WCS-01	June and August	
PR-WCS-02	June and August	
PR-WCS-03	June and August	
PR-WCS-04*	June and August	
PR-WCS-05	June and August	
PR-WCS-06	June and August	
PR-WCS-07	June and August	

Note:
* Samples will be collected two weeks prior to and two weeks after June and August collections.

Table 8.2.5 summarizes the Peconic River ROD-required and surveillance monitoring program for all samples collected between the BNL STP outfall and Connecticut Avenue. The data quality for all samples will support comparison with the Peconic River Remedial Investigation and confirmation sampling data. Specific supplemental sampling efforts may be required based on the results of routine sampling. These will be identified, as needed, separate from the EMP.

Table 8.2.5 Peconic River Post-Cleanup Monitoring Summary

AOC	Name	Medium	No. of Samples	Parameters	Method	Frequency
30	Peconic River	Surface water[1]	22	Methyl mercury Mercury TSS	EPA Method 1630 EPA Method 1631 EPA Method 160.2	Twice annually (June and August)
30	Peconic River	Surface water[1]	74[3]	Chlorophyll-a Total Phosphorus Total Nitrogen Nitrate/Nitrite Total Kjeldahl Nitrogen TSS Turbidity DO pH Temperature Depth	SM18 10200 H EPA Method 365.2 EPA Method 300.0 EPA Method 353.1 EPA Method 351.2 EPA Method 160.2 Field measurement Field measurement Field measurement Field measurement Field measurement	Two or four times annually[3] (May to September)

AOC	Name	Medium	No. of Samples	Parameters	Method	Frequency
30	Peconic River	Surface water[1] near HQ sediment trap	3	TSS DO	EPA Method 160.2 Field measurement	Every 2 weeks Every 2 weeks (April – October)
30	Peconic River	Sediment within or beneath HQ sediment trap[2]	3	Mercury PCBs Cesium-137	EPA Method 7471a EPA Method 8082 EPA Method 901.1	Prior to trap removal
30	Peconic River	Sediment[2]	25 5 5	Mercury PCBs Cesium-137 Mercury, Silver, Copper Pesticides PCBs Gamma-emitting radionuclides	EPA Method 7471a EPA Method 8082 EPA Method 901.1 EPA Method 7471a EPA Method 8081 EPA Method 8082 EPA Method 901.1	Annually (June)
30	Peconic River	Fish on BNL property	20	Mercury PCBs Gamma-emitting radionuclides	EPA Method 7471a EPA Method 8082 EPA Method 901.1	Annually (between June and August)
30	Peconic River	Fish outside BNL property	30	Mercury Gamma-emitting radionuclides	EPA Method 7471a EPA Method 901.1	Annually (between June and August)

Notes:
[1] Sample type is Grab
[2] Sample type is Core
[3] 21 stations are sampled in June and August; 8 are also sampled two weeks prior to and two weeks after the June and August sample events
See Table 8.2.4 for station identification.

TOTAL SAMPLING AND ANALYSIS COSTS

The proposed sampling program will result in an annual cost of $86,400. Peconic River post-cleanup monitoring is a new program and 2008 is the second year of inclusion in the EMP. The distribution of the costs is summarized in Table 8.2.6.

Table 8.2.6 Sampling and Analysis Costs

AOC	Name	Medium	Emphasis	Cost[1]
30	Peconic River	Surface water	Methyl mercury, Mercury and TSS	$29,800
30	Peconic River	Surface water	Water Quality parameters and HQ TSS and dissolved oxygen	$24,600
30	Peconic River	Peconic River sediment on and off BNL property and HQ sediment trap sediment	Mercury, silver, copper, PCBs, pesticides, Cs-137 and other Gamma-emitting radio-nuclides	$16,200
30	Peconic River	Peconic River fish on and off BNL property[2]	Mercury, PCBs, and Gamma-emitting radio-nuclides	$15,800
			Total Cost	$86,400

Notes:
[1] Costs include contract analytical laboratory costs and sampling labor.

FY2007 Costs $86,400
Difference 0

See Appendix B for the environmental monitoring matrix summary for this DQO.

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FARM AND GARDEN VEGETABLES AND SOILS

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 2, November 30, 2006

IMPLEMENTATION DATE January 1, 2008

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

The sampling date for farm vegetation was changed from 2007 to 2008 in order to stager sampling efforts between various media that are on a 5-year rotation. This change is reflected in the cost of sampling table.

DESCRIPTION AND TECHNICAL BASIS

Farm and garden vegetables and associated soils have been sampled in the past in order to document potential impacts from reactor operations and to address potential concerns on the part of the public. Sampling locations for farm vegetables and soil are downwind of BNL (primarily northeast and southeast). Results from this sampling program have consistently indicated that no man-made radionuclides attributable to BNL operations have ever been found in any farm vegetation or soil in the local area. In 2000, BNL added on-site garden vegetables and soil from a garden at the apartment complex to the sampling program, with only one vegetable showing very low detectable levels of Cs-137, a radionuclide found in some on-site soils.

Historically, reactor operations had the potential to release fission products; therefore, downwind sampling was necessary to detect the presence of these materials in air, soil, water, and biota. The three reactors on site are no longer operating. The BGRR and HFBR shared a 300-ft stack for air emissions, and the BMRR had its own 100-ft stack for air emissions. Due to the nature of the emissions from the reactors, both stacks required continuous emissions monitoring.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

____ Compliance
_x_ Support compliance
_x_ Surveillance
____ Restoration

- DOE Order 450.1, Environmental Protection Program (2003), requires DOE sites to maintain surveillance monitoring to determine possible effects of DOE activities on the on- and off-site environment and natural resources. DOE Order 5400.5, Radiation Protection of the Public and Environment (1990), requires DOE sites to maintain surveillance monitoring for determining radiological impacts to the public and environment.

- Surveillance monitoring to determine impacts from reactor operations can also be considered a "best management practice" to ensure the early detection of potential contamination in order to better protect the public and environment.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

The problem for study under this DQO is the conversion of the sampling program for farm vegetables and associated soil from an annual program to one in which sampling occurs once every 5 years, or as necessary as determined by other sampling procedures or the EWMSD Environmental Event Response Procedure, while maintaining the annual sampling program for garden vegetables grown on site, as well as soils taken from the on-site garden.

Step 2: Identify the Decision

The desired decisions under this DQO can be stated as questions.

- Are radionuclides attributable to BNL operations present in off-site soil used to grow vegetables, and in the vegetables themselves?
- Does the cessation of reactor operations justify the suspension or reduction in frequency of farm and garden vegetable sampling?
- Will a graded approach to farm vegetable and soil sampling that allows for tiered sampling as needed or required based on results from monitoring other media (i.e., air, water, soil) be sufficiently protective of the public and environment?
- Does soil used to grow garden vegetables on site, and do the vegetables themselves, contain radionuclides attributable to BNL operations?

Step 3: Identify Inputs to the Decision

Inputs to support the decisions in Step 2 above are listed below:

- Date of reactor closures
- Historic farm and garden vegetation results as reported in annual Site Environmental Reports
- Identification of other points of air discharge that could potentially release long-lived radionuclides that could reach and be incorporated in farm and garden vegetables
- Prevailing wind direction
- Results from other monitoring data (e.g., air)
- EWMSD field logs and records maintained by field sampling staff
- EWMSD Environmental Monitoring SOPs
- Documentation of the sampling and analysis program
- Historic soil analysis data from area farms, the BNL apartment area garden, and control locations

Step 4: Define the Study Boundaries

The areas for inclusion in this study are area farms downwind of BNL. Based on prevailing winds, this includes farms to the northeast and southeast. Also included in the boundary is the on-site vegetable garden located at the apartment area, and control locations upwind of the Laboratory. Sampling would be conducted once every 5 years to confirm the presence or absence of anthropogenic radionuclides originating from BNL in farm vegetation, and annually for garden vegetables and soil taken on site.

Step 5: Develop the Decision Rule

Decision 1

Are radionuclides attributable to BNL operations present in off-site soil used to grow farm vegetables and in the farm vegetables themselves?

If historical data on farm vegetables and soil indicate that no anthropogenic radionuclides attributable to BNL are present, **then** consider reduction or elimination of off-site farm vegetables and soil sampling.

Decision 2

Does the cessation of reactor operations justify the suspension or reduction in frequency of farm and garden vegetable sampling?

If all BNL research reactors are permanently shut down, **then** annual surveillance monitoring in support of reactor operations of local farm vegetables and soils can be discontinued.

If BNL guests and apartment dwellers continue to utilize the on-site vegetable garden, **then** annual sampling of garden vegetables and the soil they grow in should continue, due to the continued presence of historic radionuclide contamination in some BNL soils.

Decision 3

Will a graded approach to farm and garden vegetable and soil sampling that allows for tiered sampling as needed or required, based on results from monitoring other media (i.e. air, water, soil), be sufficiently protective of the public and environment?

If surveillance monitoring under the air and soil programs indicate the presence of anthropogenic radionuclides at the BNL boundary air monitoring stations, or confirmatory sampling indicates the presence of radionuclides originating from BNL, **then** the BNL Environmental Event Response Procedure shall be followed to determine the need for resuming annual farm vegetable surveillance monitoring.

Decision 4

Does soil used to grow garden vegetables on site, and do the vegetables themselves, contain radionuclides attributable to BNL operations?

If garden vegetables and soils taken on site contain significant levels of radionuclides attributable to BNL operations, **then** the BNL Environmental Event Response Procedure shall be followed to determine the need to close or move the garden to a more appropriate location and inform gardeners of the identified contamination.

Step 6: Specify Acceptable Error Tolerances

Surveillance monitoring is used to identify areas that may be potentially affected by operations of BNL facilities. BNL has historically sampled local farm vegetation for the presence of anthropogenic radionuclides potentially released from BNL operations. Historic data indicates that no BNL-related anthropogenic radionuclides have ever been detected in nearby farm vegetation or soils. Since all BNL reactors are no longer operational, there should be no potential for the release of long-lived anthropogenic radionuclides from BNL operations. Other environmental surveil-

lance (including on-site soil, vegetation, and air monitoring) allow for early detection of operational constituents that could potentially affect human health and the environment. Confirmatory sampling every 5 years is designed to verify the continued absence of anthropogenic radionuclides originating from BNL. The EWMSD Environmental Event Response Procedure provides a mechanism for the reestablishment of annual surveillance sampling of farm vegetables and associated soils, if necessary, after a documented event and can be used should evidence of BNL-attributable radionuclides be discovered in confirmatory sampling.

Errors for radiological data associated with on-site garden vegetables and soil should be no larger than 20 percent at a 2-sigma significance level. Data with higher errors should be reviewed for accuracy and re-analysis or may be considered not to be valid data.

Step 7: Optimize the Design

Monitoring requirements for farm vegetation and associated soils are shown below. These sampling and analysis requirements will be implemented every 5 years to confirm the continued absence of anthropogenic radionuclides attributable to BNL. The next scheduled sampling of farm vegetables would occur in 2008. Garden vegetables and associated soil will be sampled annually.

2008 Farm Vegetables and Associated Soil Monitoring Program		
Analysis	Sampling Location	Frequency (times per summer)
Radiological (gamma)	Lewin's Farm	5 to 7 vegetables 1 soil sample
	Bruno Farm	4 to 5 vegetables 1 soil sample
	Mays Farm	5 to 7 vegetables 1 soil sample
	Rt. 25 Farm	1 to 2 vegetables 1 soil sample
	River Road Farm	1 to 2 vegetables 1 soil sample
	Cornell Farm (control)	1 to 3 vegetables 1 soil sample
2008 Annual Garden Vegetables and Associated Soil Monitoring Program		
Analysis	Sampling Location	Frequency (times per summer)
Radiological (gamma)	BNL Garden	5 to 7 vegetables 1 soil sample

TOTAL SAMPLING AND ANALYSIS COST FOR MONITORING PROGRAM

Sampling costs for the entire farm and garden vegetable sampling would increase by $567 due to increased laboratory costs.

FY2006 Costs	$3,900
FY2008 Costs	$19,500
Difference	+$15,600

See Appendix B for the monitoring program for this DQO.

PRECIPITATION MONITORING

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 1, November 30, 2005

IMPLEMENTATION DATE January 1, 2006

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

There are no changes proposed for this DQO for CY2008.

DESCRIPTION AND TECHNICAL BASIS

BNL currently samples precipitation on a quarterly basis at two locations on site (Station P4 at the apartment area and S5 at the STP) in support of reactor operations. BNL's three reactors have all been permanently shut down. The BGRR ceased operations in 1968 and is currently undergoing decontamination and decommissioning. The HFBR was permanently shut down in 1999 and has been placed in a safe and secure configuration. The BMRR was permanently shut down in December 2000 and is also in a safe and secure configuration. Historical precipitation data has been reported as providing little, if any, indication of BNL-related radionuclides in precipitation. However, historical data within the past decade does indicate several high values of gross alpha/beta, tritium, and Sr-90 that had been considered erroneous but were never investigated. Although reactor operations have terminated, questions from historical precipitation data persist. Therefore, continued monitoring is warranted until sufficient documentation exists to discontinue monitoring.

Additionally, the cleanup of the Peconic River, which was primarily driven by mercury in sediments, has raised questions about the importance of atmospheric deposition of mercury. To answer this question, mercury analysis is being added to the precipitation monitoring program.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

____	Compliance
x	Support compliance
x	Surveillance
x	Restoration

- DOE Order 450.1, *Environmental Protection Program* (2003), requires that DOE sites maintain surveillance to monitor the effects, if any, of DOE activities on the on- and off-site environment and natural resources. DOE Order 5400.5, *Radiation Protection of the Public and Environment* (1990), requires DOE sites to maintain surveillance monitoring to determine radiological impacts to the public and environment.

- Surveillance monitoring to determine impacts from BNL operations can also be considered a "best management practice" to ensure the early detection as well as long-term accumulation of potential contamination in order to better protect the public and environment.

- Peconic River cleanup and subsequent monitoring for mercury and methyl mercury in order to document that the river remains in a clean state warrants investigating whether atmospheric deposition of mercury is significant or not.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Historical precipitation data suggests the occasional detection of radionuclides related to BNL operations. Therefore, the problem is documenting whether or not BNL-related radionuclides are deposited in the environment through precipitation. Additionally, precipitation monitoring may be able to determine whether or not mercury is being deposited from the atmosphere in precipitation.

Step 2: Identify the Decision

The desired decision for precipitation monitoring is:

Does precipitation contain radionuclides attributable to BNL operations and is mercury being deposited from the atmosphere?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 are listed below.

- Historical precipitation data
- Closure of all nuclear reactors at BNL (source term)
- EWMSD sampling logs and field notebooks

Step 4: Define the Study Boundaries

This DQO only affects the current precipitation sampling at BNL stations P4 and S5. Sampling occurs on a quarterly basis at both locations. P4 is located near the apartment complex and S5 is located at the STP. No off-site precipitation is collected for analysis at those locations.

Step 5: Develop the Decision Rule

Decision 1

Does precipitation contain radionuclides attributable to BNL operations and is mercury being deposited from the atmosphere?

If quarterly precipitation data show no evidence of BNL-related radionuclides, **then** report data as usual in the annual Site Environmental Report and continue quarterly monitoring.

If quarterly precipitation data show evidence of mercury from atmospheric deposition, **then** report data in the annual Site Environmental Report and continue monitoring quarterly.

If quarterly data indicate the potential presence of BNL-related radionuclides, **then** initiate the Environmental Event Response Procedure to investigate the data validity and source, and report the data in the annual Site Environmental Report.

If data covering a period of 5 years post-reactor operations indicate that no BNL-attributable radionuclides are present and data covering a period of 5 years since initiation of mercury testing indicate no measurable levels of mercury from atmospheric deposition, **then** precipitation monitoring may be discontinued.

Step 6: Specify Acceptable Error Tolerances

Radiological data should have reported values with associated two-sigma errors no greater than 20 percent. All gross alpha values above 15 pCi/L should be analyzed to identify the nuclide-specific composition. For gross beta, the prompt for identification of the nuclide-specific composition is values above 50 pCi/L. Mercury analysis should be conducted under EPA method 1631 and meet the quality assurance guidelines of this method.

Step 7: Optimize the Design

Quarterly precipitation data should be acquired from on-site precipitation-monitoring locations and analyzed for gross alpha/beta, tritium, and gamma emitting radionuclides. Results should be reported to the subject matter expert and reviewed quarterly, and any abnormalities in the data investigated accordingly.

Precipitation Surveillance Monitoring				
Matrix	No. of Samples	Analysis	Frequency	Type
Precipitation	8	Alpha/Beta	Annual	Grab
	8	Gamma	Annual	Grab
	8	Tritium	Annual	Grab
	8	Sr-90	Annual	Grab
	8	Hg	Annual	Grab

TOTAL SAMPLING AND ANALYSIS COST FOR MONITORING PROGRAM

There is no change in cost to the program in 2007.

FY2007 Costs	$3,922
FY2008 Costs	$3,922
Difference	0

See Appendix B for the monitoring program for this DQO.

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TERRESTRIAL VEGETATION AND SOIL MONITORING

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 3/Novermber 30, 2007

IMPLEMENTATION DATE January 1, 2008

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

Changes needed to reflect termination of small mammal sampling.

DESCRIPTION AND TECHNICAL BASIS

Historical operations of BNL have resulted in the distribution of Cs-137 in landscape soils. The majority of this contamination has been remediated. However, low levels of Cs-137 remain in specific landscape areas at or below cleanup goals. In addition, soils at or below cleanup goals in these areas have been covered with clean fill material, 6 to 12 inches in depth. Other areas containing higher levels of Cs-137 contamination (650 Sump outfall and the former HWMF) have recently been cleaned up. Cs-137 at detectable levels are still present at the former HWMF, but have been covered with clean fill material to allow natural attenuation. The continued presence of soil contamination and the potential for uptake by plants, which can then be passed along to animals, must be monitored. This can be done through surveillance monitoring of deer. Soil and vegetation monitoring within the former HWMF is necessary to document whether or not uptake is occurring. Additionally, the periodic assessment of soil and vegetation within cleaned up landscaped soils should be conducted in order to determine uptake and/or redistribution of contaminants. The remainder of the soil and vegetation monitoring at BNL will follow a graded approach as outlined below.

The terrestrial vegetation and soil-monitoring program at BNL is being designed to supplement and support other monitoring efforts in a graded approach. Historically, soil and vegetation monitoring have been somewhat limited to farm and garden vegetation and soils associated with the locations where the produce was sampled. This sampling had been conducted in support of reactor operations to document impacts or lack thereof from these operations. Since the farm and garden vegetable sampling is linked to reactor operations and the reactors have been placed into a permanent shutdown mode, and sampling is no longer necessary. In addition, since all other current operations only produce short-lived radionuclides that are not transported at significant distances, the need for continuous or routine soil and vegetation monitoring is no longer necessary.

In addition, vegetation and soil sampling occurred along with sampling of goose fecal material in an attempt to document uptake of Cs-137 by the geese. The goose fecal material study lasted for 2 years, with only slight indications that geese are obtaining Cs-137 through ingestion. That program was dropped because it was not precise enough to provide a clear indication of uptake. Therefore, the terrestrial vegetation and soil monitoring should continue in a graded approach in order to document any effects that BNL operations may have on the local environment. As stated

above, this approach will be graded based on results from surveillance of air monitoring and to a limited extent surveillance monitoring of deer.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

___ Compliance
_x_ Support compliance
_x_ Surveillance
_x_ Restoration

- DOE Order 450.1, Environmental Protection Program (2003), requires that DOE sites maintain surveillance to monitor the effects, if any, of DOE activities on the on- and off-site environment and natural resources. DOE Order 5400.5, Radiation Protection of the Public and Environment (1990), requires DOE sites to maintain surveillance monitoring for determining radiological impacts to the public and environment.
- DOE-STD-1153-2002, A Graded Approach for Evaluation of Radiation Doses to Aquatic and Terrestrial Biota, recommends sampling design to assess radiological impacts to the biotic community.
- Surveillance monitoring to determine impacts from BNL operations can also be considered a "best management practice" to ensure the early detection of long-term accumulation of potential contamination to better protect the public and environment.
- Periodic monitoring to determine effectiveness of cleanup operations is necessary to document compliance with requirements of the Record of Decision for Operable Unit I former HWMF.
- Periodic monitoring is necessary to determine effectiveness of cleanup operations of landscape soils in order to calculate a dose to biota.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

BNL has been in operation since 1947. This long history of operation has included various large-scale experiments, as well as large user facilities such as reactors and accelerators. The primary source of potential contamination was the operation of reactors. Since all reactors have been permanently shut down, the need for continued soil and vegetation monitoring is less necessary and can be carried out under a graded approach. Since air monitoring is conducted at six fixed positions, it is reasonable to expect that any deposition of airborne materials would occur at the same location. Therefore, in order to support the air monitoring program, both soil and vegetation samples should be obtained from the vicinity of the six air monitoring locations when radionuclides attributable to BNL or particulate contamination are detected that may affect biota. The cleanup of the former HWMF has been completed. Under the requirements of the Long Term Maintenance and Monitoring Plan for OU I and V, vegetation and soil sampling should occur in the first year and every 5 years after completion of cleanup to document the success of the cleanup operation.

Step 2: Identify the Decision

The desired decisions for this monitoring program can be stated as follows.

- Will a graded approach to soil and vegetation monitoring using the results of air sampling be protective of the environment?

- Are radionuclides being taken up by vegetation at the former HWMF and are they also found in surface soils within this facility.
- Are radionuclides being taken up by vegetation in the cleaned up landscape soils and 650 sump areas?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 are listed below:

- DOE-established dose to biota guidelines of 1 mrad/day for flora and fauna
- EWMSD field logs and records maintained by field sampling personnel
- EWMSD Environmental Monitoring standard operating procedures
- Closure reports for Landscape Soils Remediation
- Project work plans for Operable Units I, IV, and VI
- Historic soil and vegetation data
- Historic and current air monitoring data
- Close-out report for the former HWMF

Step 4: Define the Study Boundaries

The boundaries of this study include the entire BNL site as well as control locations west and northwest of the Laboratory. Deposition of airborne particulates is likely to occur at any location at the Laboratory, but detection is most likely in the downwind sectors. For this reason, soil and vegetation samples will be taken primarily in the vicinity of air monitoring stations (six locations) when air monitoring indicates that sampling is needed or every 3-5 years. Air monitoring occurs on a routine basis and allows for early detection of potential environmental releases. If airborne contaminants that may affect biota are detected at levels above historic background, soil and vegetation sampling can be carried out. The close-out report for the former HWMF specifically identifed the former HWMF and its associated wetlands as a defined study area.

Step 5: Develop the Decision Rule

Decision 1

Will a graded approach to soil and vegetation monitoring using results of air sampling be protective of the environment?

If air monitoring identifies particulates containing levels of gamma-emitting radionuclides higher than historic background levels, **then** soil and vegetation samples will be taken near the air station with the higher than background detection levels.

If soil and vegetation sampling is triggered, and results indicate an area of previously unknown contamination or levels higher than established cleanup criteria, **then** an evaluation will be completed under the EWMSD Environmental Event Response Procedure to determine a path forward.

Decision 2

Are radionuclides being taken up by vegetation at the former HWMF and are they also found in surface soils within this facility.

If soil and vegetation sampling results in the first year after cleanup do not indicate radionuclides being taken up by plant and in the surface soils at the former HWMF, **then** sampling will take

place in year 5 after cleanup to reconfirm presence/absence of radionuclides in vegetation and surface soils.

If soil and vegetation sampling results indicate radionuclides being taken up by plants and in surface soils, **then** an evaluation will be completed under the Environmental Event Response Procedure to determine a path forward.

Decision 3

Are radionuclides being taken up by vegetation in the cleaned up landscape soils and 650 sump areas?

If soil and vegetation sampling results from within historically cleaned up landscape soils do not indicate radionuclides being taken up by plants or in the surface soils, **then** sampling will take place every 5 years to reconfirm presence/absence of radionuclides in vegetation and surface soils.

If soil and vegetation sampling results indicate radionuclides being taken up by plants and in surface soils, then an evaluation will be completed under the Environmental Event Response Procedure to determine a path forward.

Step 6: Specify Acceptable Error Tolerances

Terrestrial vegetation and soil sampling will be conducted based on a graded approach that relies on the detection of contaminants in small mammals and air samples. Therefore, it is acceptable to act on reasonable data. If air samples confirm the presence of contaminants potentially affecting soil and vegetation (i.e., above historic background levels), then it is prudent to obtain soil and vegetation samples to verify effect or lack thereof in these media.

For vegetation and soil sampling within the former HWMF, 650 Sump area, and from landscaped soils cleanup areas, analytical data showing radionuclides above background should be reported with errors less than 20 percent. Values with errors greater than 20 percent will be reviewed and may warrant additional sampling for verification.

Step 7: Optimize the Design

If air sampling indicates the presence of a contaminant in the particulate filters above historic background levels, soil and vegetation sampling will occur within 100 ft of the air monitoring station. Four soil samples and four vegetation samples will be taken following established procedures. One sample of each media will be taken in each of the four major compass directions to document whether the airborne contaminant is detectible in either the soil or vegetation. When a small mammal is sampled and a positive result above 10 pCi/g wet weight is obtained, the subject matter expert will investigate the location and determine the sampling requirements and area to be covered. Sampling triggered by small mammal data will initially not exceed 10 soil and 10 vegetation samples within the designated sampling area. When soil and vegetation sampling occurs, at least one off-site soil and vegetation sample must be obtained from established background locations.

Soil and vegetation sampling will necessitate obtaining at least five samples of each media in the upland area and two samples of sediment and emergent vegetation from the eastern portions of the former HWMF wetlands. Additionally 10 samples of each media should be obtained from the cleaned up landscape soils area and 2 samples of each media from the 650 Sump area. The first

year of sampling at the FHWMF was 2006, therefore the second round of sampling should occur in 2010.

Terrestrial Soil and Vegetation Surveillance Monitoring				
Matrix	Number of Samples	Analysis	Frequency	Type
Vegetation	12 + 2QA	Gamma	Annual	Grab
Soil	12 + 2QA	Gamma	Annual	Grab

TOTAL SAMPLING AND ANALYSIS COST FOR MONITORING PROGRAM

The sampling program described in Step 7 will result in no net change in cost.

FY2007 Costs	$14,637
FY2008 Costs	$14,637
Difference	0

See Appendix B for the monitoring program for this DQO.

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DEER AND SMALL MAMMAL SAMPLING

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 2/November 30, 2007

IMPLEMENTATION DATE January 1, 2008

POINT OF CONTACT Tim Green (631) 344-3091

SUMMARY OF PROPOSED CHANGES

Small mammal sampling will discontinue. There are no changes being made in deer sampling requirements.

DESCRIPTION AND TECHNICAL BASIS

BNL has documented the presence of the radionuclide Cs-137 (Cs-137) within landscape soils and other operational areas on site. Faunal monitoring of various wildlife species in 1992 identified the presence of Cs-137 in the tissue of deer and other small mammals. Of all the mammals inhabiting BNL, deer are the only species that are in the direct consumption pathway of humans. Deer are known to acquire Cs-137 through the ingestion of vegetation that has Cs-137 uptake, as well as by direct ingestion of contaminated soils. In 1996, BNL began a program of sampling deer on and off site for gamma analysis of meat and liver. Srontium-90 (Sr-90) analysis in bone was added to the program in 2000 in order to investigate levels present in this matrix. Statistical analysis on the sampling requirements of deer taken through 1998 suggested that 25 samples on site and 40 samples off site were necessary to have sufficient confidence in detecting the average presence of Cs-137 within the deer population. Fewer samples were required on site due to the fact that Cs-137 is known to be higher in on-site deer. The higher number of off-site samples was needed to verify the lower concentrations seen off site. It should be noted that in most years the required number of samples has not been acquired due to the method of acquisition (road-killed deer or hunter donations).

Landscape soils containing Cs-137 were remediated in 2000, with the remaining contamination at or below assigned cleanup standards. Other areas known to contain Cs-137, including the 650 Sump Outfall, STP sand filter beds, and the former HWMF were all completed by September 2005.

In 2000, BNL began sampling squirrels in order to build a baseline of information on small mammals. Squirrels were chosen because of the ease of obtaining samples, the similarity of their diet to that of deer (except that deer also ingest soil), and squirrels' smaller home range. The smaller home range enables BNL ecologists to determine where an animal may have obtained contamination, should any be found. Sampling squirrels also allows for a much broader understanding of where radiological contamination at BNL exists because samples can be gathered across the Laboratory site instead of relying on road kill, as in the current deer-sampling program.

BNL now proposes to eliminate small mammal sampling for several reasons. The first being difficulty in sampling. Through several years of efforts with little success. The original idea of sam-

ples being obtained easily, turned out to be a not so easy task to complete on a quarterly basis. The second reason for eliminating sampling is that BNL has sufficient data that indicates that for known contaminant monitoring. squirrels are suitable surrogates in highly localized areas. Since BNL has conducted significant clean up of contaminated soils, the need for any localized faunal sampling is greatly reduced. BNL recommends continuation of deer sampling as the primary mechanism to document environmental effects on terrestrial fauna.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

____ Compliance
____ Support compliance
_x_ Surveillance
____ Restoration

- DOE Order 450.1, *Environmental Protection Program* (2003), requires that DOE sites maintain surveillance to monitor the effects, if any, of DOE activities on the on- and off-site environment and natural resources. DOE Order 5400.5, *Radiation Protection of the Public and Environment* (1990), requires DOE sites to determine radiological impacts to the public and environment.

- Surveillance monitoring to determine impacts from past practices can be considered a "best management practice" to ensure the early detection of potential radiological contamination in order to better protect the public and environment.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Past practices at BNL have resulted in soil contaminated with Cs-137. Although most areas of radiological soil contamination have been remediated, two areas with higher contamination (STP and the former HWMF) are either in the process of cleanup or scheduled for cleanup in the next few years. Regardless of when cleanup is completed, low levels of radiological contamination will persist in the environment and may be available to wildlife through the consumption of plants via uptake from the soil, or through the direct consumption of contaminated soils. To determine the impact of Cs-137 on wildlife and the potential for transfer to the human food pathway, BNL should monitor the deer population to track and trend Cs-137 levels tissues that are normally eaten. In addition, since small mammals have smaller home ranges, a program to monitor small mammals should be maintained to refine the understanding of Cs-137 contamination on site.

Step 2: Identify the Decision

The desired decisions for the deer and small mammal surveillance monitoring programs are:

- Are Cs-137 levels in deer meat above levels considered protective of human health?
- Are the Cs-137 levels in deer continuing to decline after remediation of contaminated soils?
- Are levels of Cs-137 in deer from areas within one mile of the BNL identical to on-site levels?
- Do small mammals (squirrels) accurately depict Cs-137 contamination across the Laboratory site? (Removed for 2008)
- Can small mammals be a surrogate sampling medium for deer? (Removed for 2008)

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 are listed below.

- DOE-established dose guideline of 10 mrem/year for the general public
- NYSDOH guideline consumption rate - 64 lb/year/person of deer meat > 6.9 pCi/g of Cs-137 (wet weight)
- Field logs and records maintained by EWMSD field sampling personnel
- EWMSD environmental monitoring SOPs
- Documented remediation of radiologically contaminated soils
- Records of Decision for OU I, IV, and VI
- Historic vegetation sampling results
- Historic soil sampling results
- Special vegetation sampling results
- Historic deer and small mammal sampling results

Step 4: Define the Study Boundaries

The boundaries of the study include a comparison of deer taken on site and those taken within 1 mile of BNL's boundary, as well as deer taken more than 1 mile from BNL (generally considered background or control deer). Sampling is conducted annually (with trends developed for a rolling 5-year period) and is conducted as evenly across months as can be achieved through opportunistic sampling of deer killed in vehicle accidents.

The study boundary for small mammal sampling is within the BNL property, with control samples taken at distances greater than 1 mile from the Laboratory. Sampling is on an annual basis, with sample events spread across the four calendar quarters.

Step 5: Develop the Decision Rules

Decision 1

Are Cs-137 levels in deer meat above levels considered protective of human health?

If the monitoring data show the data to be consistently below 6.9 pCi/g wet weight, **then** the monitoring will be maintained.

If deer meat samples suggest an average annual value of Cs-137 higher than 6.9 pCi/g wet weight, **or** if a single value in a deer sample is higher than 11.64 pCi/g wet weight (highest value to date), **then** an evaluation will be conducted under the EWMSD Environmental Event Response Procedure to determine the path forward.

Decision 2

Are the Cs-137 levels in deer continuing to decline after remediation of contaminated soils?

If Cs-137 levels in on-site deer meat samples indicate a continued decline after remediation of contaminated soils, **then** monitoring will be maintained.

If Cs-137 levels in on-site deer reach background levels, **then** a review of the program and data will determine whether the program should continue.

If Cs-137 values in on-site deer meat samples begin to increase after remediation of contaminated soils, **then** an evaluation will be conducted under the EWMSD Environmental Event Response Procedure to determine the path forward.

Decision 3

Are levels of Cs-137 in deer from areas within one mile of BNL identical to on-site levels?
If Cs-137 concentrations in deer meat samples taken within 1 mile of BNL are statistically the same as on-site values, **then** monitoring will be maintained.

If Cs-137 concentrations in deer meat samples taken within 1 mile of BNL indicate an increasing trend or steady trend compared to on-site values, **then** an investigation will be conducted under the EWMSD Environmental Event Response Procedure to determine the path forward.

Decision 4

Do small squirrels accurately depict Cs-137 contamination across the Laboratory site?

If squirrel sampling clearly shows Cs-137 contamination in wildlife across the Laboratory site, **then** the sampling program will be reviewed for a possible reduction in deer sampling and increase in squirrel sampling. Difficulty in obtaining significant sample numbers prevents implementing this decision rule.

If squirrel sampling does not appear to provide a clear indication of Cs-137 contamination in wildlife across the Laboratory, **then** small mammal sampling shall be reviewed for reduction or elimination. Due to difficulty in obtaining significant numbers of squirrels, this decision should be eliminated as should sampling squirrels.

Decision 5

Can small mammals be an alternate sampling medium for deer?

If statistical comparison of on-site small mammal sampling data and on-site deer data for Cs-137 indicates that small mammal data are comparable to deer data, **then** the faunal monitoring program will be evaluated for a possible reduction in deer sampling and increased sampling of small mammals.

If statistical comparison of small mammal and deer data indicates that they are not similar or comparable, **then** the small mammal sampling will be considered for elimination.

While it appears that small mammals contain similar amounts of Cs-137, difficulty in obtaining sufficient numbers, prevents them from being a good alternative to continued deer sampling.

Step 6: Specify Acceptable Error Tolerances

The presence of Cs-137 in some deer samples indicates that Cs-137 in the environment is available to humans through the ingestion pathway. Hunters take approximately 2,000 deer each year in Suffolk County, some of which are obtained within 1 mile of BNL. In the past, high values of Cs-137 in deer have been examined, considered to be accurate, and reported to the general public, then subsequently discovered to be in error. The values were, in fact, much lower than first reported. This “false positive” caused substantial concern to the community at large. False positives should be minimized. All values greater than historic high values are to be investigated and verified through multiple retesting. Cs-137 is the single highest contributing factor for potential expo-

sures to the general public from BNL operations. BNL must have an accurate understanding of Cs-137 distribution in deer.

Small mammal sampling was initiated in 2000 to determine its appropriateness as a surrogate for deer sampling. Out of 20 on-site samples over 2 years, three samples could be considered high for Cs-137 in comparison to all others. The three samples originated near known sources of Cs-137 contamination. Because squirrels are available to other wildlife as a food source, having an understanding of where squirrels are acquiring Cs-137 is important in order to protect other wildlife. Accuracy of data is important to verify the presence or absence of Cs-137 concentrations in the squirrels sampled. Due to difficulties in obtaining samples over the past three years this sampling program should be eliminated.

Step 7: Optimize the Design

To get sufficient data for comparison and in order to be statistically sound, samples must be taken both on and off site. Past efforts indicate that 25 on-site and 40 off-site samples should be obtained annually in order to produce a statistically accurate average concentration for Cs-137 in deer tissues. The lower number of on-site samples is due to the higher concentration of Cs-137 in on-site deer, which results in better detection. The higher number of samples off site is necessary due to the high incidence of non-detections and very low detectable levels in off-site deer. All deer sampled will be tested for gamma-emitting radionuclides in the flesh (meat) and liver (when available), and Sr-90 in bone (when available).

BNL historically has relied on opportunistic sampling through hunter donations and notification of road-killed deer on site. BNL recently (2002) acquired the ability to selectively sample deer on site. Therefore, BNL should utilize both methods of obtaining deer for sampling purposes on site (e.g., continue utilizing road-killed deer, but supplement this by obtaining the number of deer necessary to reach the required 25). Selective sampling should utilize five designated sampling locations that have been established on the Laboratory property. Off-site sampling of up to 40 deer will still be conducted through collection of road-killed deer and acceptance of hunter donations, and acceptance of deer obtained through donation by other agencies such as NYSDEC and FWS.

2003 Deer and Small Mammal Sampling Program				
Deer	No. of Samples	Analysis	Frequency	Sample Type
Flesh (meat)	25 on site 40 off site + 6 QA	Gamma	Annually	Grab
Liver (as available)	25 on site 40 off site +6 QA	Gamma	Annually	Grab
Bone (as available)	25 on site 40 off site + 6 QA	Sr-90	Annually	Grab

TOTAL SAMPLING AND ANALYSIS COST FOR MONITORING PROGRAM

No net change in cost.

CY2007 cost	$46,206
CY2008 Cost	$42,606
Difference	-$3,600

See Appendix B for the monitoring program for this DQO.